

a viewpoint detection program step for detecting the location/posture of a viewpoint of the operator;

an inputting program step for inputting a real space image corresponding to the location/posture of a viewpoint of the operator;

a geometric information acquisition program step for acquiring geometric information of real object(s);

36 a recognition program step for recognizing a current relative relationship between the virtual object(s) and real object(s);

a rule memory for storing rules for controlling the action of the virtual object(s);

a computation program step for determining the next action of the virtual object(s) in accordance with the rules stored in said rule memory and in correspondence with the location/posture of the real object(s), and computing the location/posture of the virtual object(s) after the determined action; and

a presentation program step for generating at least one image of the virtual object on the basis of the location/posture of the virtual object(s) after the action and the location/posture of the viewpoint position of the operator, and for representing the mixed reality space to the operator by superimposing the image(s) of the virtual object(s) on the operator's view of the real space.

REMARKS

Applicants request favorable reconsideration and allowance of this application in view of the foregoing amendments and the following remarks.

Claims 1-39 are pending in this application, with Claims 1, 20, and 39 being independent.

Claims 1-4, 7, 9-11, 17-20, and 39 have been amended. Applicants submit that support for these amendments can be found in the original disclosure, and therefore no new matter has been added.

Claims 1-11, 14, 15, 17-19, 20-30, 33, 34 and 36-39 were rejected under 35 U.S.C. §102(b) as being clearly anticipated by U.S. Patent No. 5,577,981 (Jarvik). Claims 12, 13, 16, 31, 32, and 35 are rejected under 35 U.S.C. §103(a) as being unpatentable over Jarvik. Applicants respectfully traverse these rejections for the reasons discussed below.

As recited in independent Claims 1, 20, and 39, the present invention relates to a simulator with which an operator plays a game with virtual object(s) in a mixed reality space. A mixed reality space combines both virtual images and real space images. Accordingly, the present invention recited in Claims 1, 20, and 39 includes, *inter alia*, the feature of inputting a real space image corresponding to a location/posture of a viewpoint of an operator. Applicants submit that the cited art fails to disclose or suggest at least this feature.

In particular, Applicants submit that Jarvik is essentially directed to a virtual reality exercise machine for a single user. Since the exercise machine is directed to virtual reality (VR) and not to mixed reality (MR), i.e., Jarvik is not directed to a combination of virtual images and real space images, Jarvik does not disclose or suggest at least the feature of inputting a real space image corresponding to a location/posture of a viewpoint of a user. Accordingly, Applicants submit that the present invention recited in Claims 1, 20, and 39 is patentable over the cited art.

The dependent claims are patentable over the cited art for at least the same reasons as the independent claims, as well as for the additional features they recite.

For the foregoing reasons, Applicants submit that this application is in condition for allowance. Favorable reconsideration, withdrawal of the outstanding rejections, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

1. (Twice Amended) A simulator apparatus with which an operator plays a simulation with virtual object(s) in mixed reality space including a virtual space and real space, said simulator comprising:

a viewpoint detection [means for detecting] unit adapted to detect the location/posture of a viewpoint of the operator;

an inputting unit adapted to input a real space image corresponding to the location/posture of a viewpoint of the operator;

a geometric information acquisition [means for acquiring] unit adapted to recognize geometric information of real object(s);

a recognition [means for recognizing] unit adapted to recognize a current relative relationship between the virtual object(s) and real object(s);

a rule memory [for storing] adapted to store rules for controlling the action of the virtual object(s);

a computation [means for determining] unit adapted to determine the next action of the virtual object(s) in accordance with the rules stored in said rule memory and in correspondence with the location/posture of the real object(s), and [computing] to compute the location/posture of the virtual object(s) after the determined action; and

a presentation [means for generating] unit adapted to generate at least one image of the virtual object(s) on the basis of the location/posture of the virtual object(s) after the

determined action and the location/posture of the viewpoint position of the operator, and [for representing] to represent the mixed reality space to the operator by superimposing the image(s) of the virtual object(s) on the operator's view of the real space.

2. (Amended) The apparatus according to claim 1, wherein said presentation unit [means] further comprises:

an image-capturing unit adapted to capture [means for capturing] real space images of said operator's view of real space images of said player's view of the real space;

an image generation unit adapted to generate [means for generating] mixed reality images representing the mixed reality space by superimposing or overlaying said image(s) of the virtual object(s) on said real space images; and

a video see-through type display [means] that the operator wears wherein said mixed reality images are displayed.

3. (Amended) The apparatus according to claim 1, wherein said presentation unit [means] further comprises an optical see-through type display [means] that the operator wears wherein said virtual object image(s) are displayed.

4. (Amended) The apparatus according to claim 1, further comprising,
a status detector that detects a [detecting means for detecting] status of the operator;

wherein said computation unit [means] determines a next action of the virtual object in accordance with the rule stored in said rule memory and in correspondence with the location/posture of the real object and/or the status of the operator, and computes [computing] a location/posture of the virtual object after the determined action.

7. (Amended) The apparatus according to claim 1, wherein the real object includes the operator himself or herself, and said recognition unit [means] recognizes a current relative relationship between the virtual object and the operator.

9. (Amended) The apparatus according to claim 1, wherein the real object is an object which is fixed in position, and

said geometric information acquisition unit [means] comprises:

a predetermined memory for pre-storing location information and shape information of the real object; and

a reading unit that reads [means for reading] out the location information and shape information of the real object from said predetermined memory as needed.

10. (Amended) The apparatus according to claim 1, wherein the real object is an object which is movable but does not deform, and

said geometric information acquisition unit [means] comprises:

a predetermined memory for pre-storing shape information of the real object;
a location/posture sensor for detecting a location/posture of the real object;
and
a setting unit that sets [means for setting] a region the real object is expected to occupy in the mixed real space in accordance with the detected location/posture of the real object.

11. (Amended) The apparatus according to claim 1, wherein the real object is an operator, and

said geometric information acquisition unit [means] comprises:

a sensor for detecting a location/posture of a head of the operator; and
a setting unit that sets [means for setting] a region having a fixed, known shape that approximates the operator in the mixed reality space in accordance with the detected location/posture of the operator's head.

17. (Amended) The apparatus according to claim 11, wherein when the operator is one of the real objects, an output from said viewpoint detection unit [means] for detecting the location/posture of the viewpoint of the operator is also used as information which is to be acquired by said geometric information acquisition unit [means] and pertains to a location and shape of the operator.

18. (Amended) The apparatus according to claim 1, wherein said viewpoint detection unit [means] detects a location/posture of the head of the operator, and said apparatus further comprises a detector that detects [detection means for detecting] a location/posture of a hand of the operator; and a recognition unit adapted to recognize [means for recognizing] a relative location of the hand of the operator with respect to the head as a command on the basis of an output from said detector [detection means].

19. (Amended) The apparatus according to claim 1, wherein said presentation unit [means] comprises: an alignment unit that aligns [means for aligning] the location/posture of the real object to the location/posture of the virtual object after movement; a generation unit that generates [means for generating] an image of the virtual object after alignment in correspondence with an occlusion relationship; and a head-mounted display device.

20. (Twice Amended) An image processing method for a simulator apparatus with which an operator plays a game with virtual object(s) in a mixed reality space comprising: a viewpoint detection step for detecting the location/posture of a viewpoint of the operator;

an inputting step for inputting a real space image corresponding to the location/posture of a viewpoint of the operator;

a geometric information acquisition step for acquiring geometric information of real object(s);

a recognition step for recognizing a current relative relationship between the virtual object(s) and real object(s);

a computation step for determining the next action of the virtual object(s) in accordance with the rules stored in a rule memory, which stores rules for controlling the action of the virtual object(s), and in correspondence with the location/posture of the real object(s), and computing the location/posture of the virtual object(s) after the determined action; and

a presentation step for generating at least one image of the virtual object(s) on the basis of the location/posture of the virtual object(s) after the determined action and the location/posture of the viewpoint position of the operator, and for representing the mixed reality space to the operator by superimposing the image(s) of virtual object(s) on the operator's view of the real space.

39. (Twice Amended) A storage medium which stores a program of an image processing method for a simulator apparatus with which an operator plays a simulation with virtual object(s) in a mixed reality space including a virtual space and real space comprising:

a viewpoint detection program step for detecting the location/posture of a viewpoint of the operator;

an inputting program step for inputting a real space image corresponding to the location/posture of a viewpoint of the operator;

a geometric information acquisition program step for acquiring geometric information of real object(s);

a recognition program step for recognizing a current relative relationship between the virtual object(s) and real object(s);

a rule memory for storing rules for controlling the action of the virtual object(s);

a computation program step for determining the next action of the virtual object(s) in accordance with the rules stored in said rule memory and in correspondence with the location/posture of the real object(s), and computing the location/posture of the virtual object(s) after the determined action; and

a presentation program step for generating at least one image of the virtual object on the basis of the location/posture of the virtual object(s) after the action and the location/posture of the viewpoint position of the operator, and for representing the mixed reality space to the operator by superimposing the image(s) of the virtual object(s) on the operator's view of the real space.